TO: NASA Scientific and Technical Information Facility

Attached is a statement of the results of our interpretation of ERTS imagery of the Beaufort Sea. We wish to present this material at the Interdisciplinary Symposium on Advanced Concepts and Techniques in the Study of Snow and Ice Resources; December 2-6, 1973 at the Asilomer Conference Grounds, Monterey, California. We believe that these findings are most appropriately classified under Discipline 5, Marine Resources and Ocean Surveys; Subdiscipline E, Sea Ice Monitoring.

Project: MMC 298, DE 329: Arctic and Subarctic Environmental Analyses Utilizing ERTS-1 Imagery

Discipline 5: Marine Resources and Ocean Surveys

Subdiscipline E: Sea Ice Monitoring

Mesoscale Deformation of Sea Ice from Satellite Imagery

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Repetitive surveillance of the characteristics and behavior of sea ice in the polar regions by satellite imagery was initiated during the last decade and is being carried on by satellites of the Nimbus and Tiros series. Coverage by the Earth Resources Technology Satellite-1 imagery during the past year has aided in the accomplishment of this objective and because of certain unique characteristics of its multi-spectral scanner it has permitted the observation of ice movements on a scale not readily accessible heretofore.

Sequential, mesoscale movement and deformation in the pack ice approximately 90 km northeast of Point Barrow, Alaska has been observed in the ERTS-1 multi-spectral imagery of 19 to 22 March 1973. At this latitude, overlap of adjacent ground tracks of daily overpasses amount to about 75%. This overlap together with the coincidence of five cloud free days and a major westward movement of the pack in the Beaufort Sea Gyre, permitted observation of drift and deformation in an area of about $1.4 \times 10^4 km^2$.

Strain calculations using several 10 point arrays yielded shear and divergence rates as large as 2.7×10^{-6}/sec (1%/hr). Continuous deformation measures through the fast ice-pack ice boundary indicated a sharp change in the sign of the vorticity as the shear zone was crossed. Measured drift velocities varied from .24 m/sec to .4 m/sec (.9 to 1.4 km/hr). Angular rotations of individual floes of up to 2.7×10^{-6}°/sec (1.7°/hr) were observed.

These results indicate that detailed deformation and movement data can be obtained from sequential ERTS-1 images. Such data is useful in determining the scaling effects in the ice velocity field and for testing existing mathematical models of the response of sea ice to meteorological and hydrodynamic stresses.